REMARKS

Favorable reconsideration of this application in view of the above amendments and the following remarks is respectfully requested. Claims 1, 3-40 and 44-52 are pending in this application. By this amendment, claims 1, 24, 44 and 47 are amended to more clearly recite the subject matter of the instant application. New claims 48-52 are also added. Applicant submits that no new matter has been added and formal notice of such is solicited.

The Office Action rejects claims 1, 3-40 and 44-47 under 35 U.S.C. 112, first paragraph, as allegedly failing to comply with the written description requirement. In particular, the Office Action alleges that the term "single light emitting diode (LED)" does not appear in the specification as originally filed.

Counsel respectfully disagrees with this contention and submits that the specification supports the notion of a single LED. In any event, claims 1, 24, 44 and 47 are amended herein to recite that the phase incoherent beam of light has a **narrow spectral range**. This is supported by the specification at:

> Page 7, lines 7-9 ("Use of a narrow-bandwidth of light also maximizes the number of wavelength-based channels that may be simultaneously transmitted within any given spectral range, thereby further increasing total optical fiber data throughput.");
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> Page 9, lines 15-19 ("In such an embodiment, phase incoherent light source 506 may be a fiber-coupled superluminescent light emitting diode (SLED) that emits a phase incoherent beam of approximately 20mW of power over a spectral range of as little as 35nm into optional optical fiber 508.");
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> Page 12, lines 5-10 ("In one exemplary embodiment, the free space optical transmitter of the present invention is configured to perform wavelength division multiplexing (WDM). Assuming that the phase incoherent light source 506 is an SLED that produces approximately 20mW of power over a spectral range of 35nm, an exemplary WDM embodiment may break the bandwidth of 35nm into

4 channels with 8nm spacing, each channel having a bandwidth of 6nm with each channel modulated by a light modulator at up to 10Gbps per wavelength channel."); and

Page 12, lines 14-18 ("For a 20mW SLED that produces a 35nm linewidth, such a band limited SLED would have a power of less than 250 μwatts, which may not be sufficient power for some applications.").

New dependent claims 48-51 further recite that the spectral range of the phase incoherent beam of light is 40 nm of less. This is fully supported by the specification at:

Page 7, line 27 to page 8, line 4 ("Assuming a dispersion parameter for the atmosphere is $D_{atmos} \approx 2.8 fs/(km \cdot nm)$ for a typical SLED bandwidth of 40nm or less, a Bit-rate Length product of 893(Gb/s)-km results. Based upon the relationships described by EQ1 and EQ2, free space optical communication at 2.5 Gbps for link distances in excess of 350km may be achieved. Further, based upon the relationships described by EQ1 and EQ2, free space optical communication at 10 Gbps for link distances of approximately 90km may be achieved."); and

Page 10, lines 9-111 ("A beam of light generated with an SLED with a spectrum as wide as 40nm will experience an extinction ratio near 40dB using a standard Lithium Niobate Mach-Zender type data modulator.").

New independent claim 52 recites the 40nm of less spectral range concept but is not limited to using an LED to generate the phase incoherent light beam. This claim is supported by the specification based on the recitations on pages 9 and 10 reproduced above in connection with claims 48-51.

The Office Action rejects claims 1, 3-10, 12-17, 19-31, 33-38, 40 and 47 under 35 U.S.C. 103(a) as being unpatentable over by Doucet et al., U.S. Patent 5,786,923 (hereinafter, Doucet) in view of Liou, U.S. Patent No. 5,623,363 (hereinafter, Liou) and further in view of Buser et al., U.S. Patent No. 4,361,911 (hereinafter, Buser).

The Office Action rejects claims 11 and 32 under 35 U.S.C. 103(a) over the combination of Doucet, Liou, Buser and Meadows, U.S. Patent No. 5,381,250 (hereinafter, Meadows).

The Office Action rejects claims 18 and 39 under 35 U.S.C. 103(a) as obvious in view of Doucet, Liou, Buser in further view of Yonenaga, U.S. Patent No. 5,543,952 (hereinafter, Yonenaga).

Finally, the Office Action rejects claims 44-46 under 35 U.S.C. 103(a) as obvious in view of Doucet, Liou, Buser in further view of Huggins, U.S. Patent No. 4,799,797 (hereinafter, Huggins).

These rejections are respectfully traversed.

Doucet relates to a point-to-multipoint bi-directional wide area telecommunications network using atmospheric optical communication that includes a primary transceiver unit, a plurality of subscriber transceiver units and an optical router. Doucet does not describe the atmospheric issues, such as speckle and scintillation, in a free-space optical communication system. As a result, Doucet does not describe any techniques to mitigate these atmospheric effects. Doucet describes a laundry list of light sources and in this list includes the phrase "or other coherent and/or non-coherent light". Doucet, column 4, lines 53-57. However, Doucet does not specifically state the advantages of using one type of light source over any others that are listed.

Liou relates to a semiconductor light source, such as a light emitting diode (LED) that is capable of producing either single or multi-mode light. Liou makes no teaching or suggestion of using the light source in connection with free space optical communications. Liou also does not teach or suggest that an LED can be effectively externally modulated at very high data rates, such as multi-gigabit rates. Moreover, Liou does not teach or suggest that an LED can be effectively amplified for use in a free-space optical communication system and still retain its incoherence (Claims 6 and 28 of the present application). Liou also fails to describe that a SLED can be filtered to fit within a particular spectral channel or bandwidth, such as an ITU compliant channel (Claims 9 and 31 of the present application). Finally, Liou makes no teaching or suggestion that an LED has qualities beneficial for a free-space optical communication system,

and consequently does not acknowledge or discuss the atmospheric issues of turbulence, speckle, scintillation, etc.

Buser describes a laser retroreflector system, and in one embodiment, the simultaneous use of multiple coherent light sources. In particular, at column 6, lines 36-47, Buser describes that "multiple wavelength operation" can "reduce the effects of atmospheric scintillation" where that "[m]ultiple wavelengths λ_1, λ_2,... λ_m could be simultaneously transmitted such that incoherent addition of the different wavefronts for each λ would reduce the fluctuation of intensity across the receiver plane." Buser goes on to describe a method for generating multiple wavelengths using a "laser gain medium", that is, with a laser structure that produces coherent light at multiple wavelengths. Buser, column 6, lines 48-62. That is, Buser teaches the simultaneous use of multiple coherent light sources each at a different wavelength.

By contrast, as now clarified in independent claims 1, 24, 44 and 47, reduction of atmospheric scintillation is achieved by generating ***a phase incoherent light beam that has a narrow spectral range***, which is in contrast to the use of multiple coherent beams of light at different wavelengths as suggested by Buser. Furthermore, new dependent claims 48-51 and new independent claim 52 more specifically recite that the phase incoherent beam of light has a spectral range of 40 nm or less. Again, Buser teaches away from a phase incoherent light beam of a narrow wavelength range because Buser teaches the use of a plurality of coherent light sources at different wavelengths.

Furthermore, the simultaneous operation of a plurality of coherent light sources does not produce incoherent light. It is still phase coherent light. Due to the coherence of each individual light source, multiple colors that are near each other (e.g., a few nanometers) would experience essentially the same speckle pattern and therefore little or no scintillation mitigation would result. A phase-incoherent light source, such as a SLED, can be band-limited to a narrow wavelength range and still achieve significant reduction in speckle, whereas a combination of coherent light sources could not be band-limited and achieve such mitigation. When a combination of coherent light sources at different wavelengths is used in an attempt to produce incoherent light, numerous sources would be needed and they would need to be spectrally far

apart, covering a rather broad spectral range. Consequently, the combination of coherent sources would use a significant amount of spectral range, more than even an unfiltered SLED. This teaches away from the concepts of present invention as now recited in the claims. Thus, such a technique could not be used for wavelength division multiplexing (WDM), whereas a single SLED can be used for WDM. Further still, to use multiple coherent light sources requires additional equipment for each light source, including filters to multiplex the colors into one beam.

It is respectfully submitted that the claims of the amendments to the claims and the foregoing arguments overcome the rejections in the outstanding Office Action.

Before proceeding to Buser, the following comments are provided with respect to a combination of the teachings of Doucet and Liou, assuming, for the sake of argument, that Doucet and Liou, are combinable. One with ordinary skill in the art, without having first read the present patent application, that reads Doucet (which makes a mere passing mention of non-coherent light as a possible light source with no mention or acknowledgement in Doucet of atmospheric scintillation issues and the need to mitigate them) and Liou (for its teaching of an LED as a source of incoherent light) would not find it obvious to reduce atmospheric scintillation in a free-space optical communication system by the use of a phase incoherent light beam produced from a single incoherent light source. Doucet does not even acknowledge the issues of atmospheric scintillation nor does it describe or recognize the benefits of selecting an incoherent light source, from among the types of light sources it lists, to reduce scintillation. It is respectfully submitted that, without the improper use of hindsight, Doucet combined with Liou would not render obvious the claimed technique of reducing atmospheric scintillation in free-space optical communication with a single incoherent light source.

The outstanding Office Action dismisses the Declaration under 37 C.F.R. 1.132 of Dr. Rabinovich as not refuting the combination of Doucet and Liou that is made to allegedly render the claims obvious and thus unpatentable. However, to clarify, the Declaration of Dr. Rabinovich was submitted for exactly that purpose, that is, to refute that it would obvious to combine the teachings of Doucet and Liou to reduce atmospheric scintillation in free-space

optical communications. That is, this Declaration is being submitted to directly refute the contention in the Office Action that it would have been obvious for one with ordinary skill in the art at the same the invention is made to use a superluminscent LED for reducing atmospheric scintillation in free-space optical communications. It is therefore submitted that based on the claim amendments and arguments presented herein, together with the Declaration of Dr. Rabinovich, that the claims in the present application are patentable over the art of record.

The secondary references to Huggins, Yonenaga and Meadows add nothing further to the teachings of Doucet, Liou and Buser that relates to the subject matter described above.

Applicant submits that all pending claims are in condition for allowance, and formal notice of such is solicited. If the Examiner has any questions, the Examiner is respectfully requested to contact the undersigned at the number listed below.

Filed concurrently herewith is the amount of $250.00 for payment of fees for the additional claims. The Commissioner is hereby authorized to charge payment of any additional fees required for the above-identified application or credit any overpayment to Deposit Account No. 05-0460.

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